REMARKS

The undersigned thanks Examiner Pettitt for his continued very careful and thorough examination of the present application. The undersigned also appreciates the Examiner's indication that claims 46-48, 50, 51 and 53 are allowed, and that claims 12-22, 28-31 and 33-38 contain allowable subject matter.

Herein, claim 1 has been amended to state that the storage vessel is adapted to deliver therefrom a metered quantity of hydrogen on demand for use as a fuel. No new matter has been entered; basis for this new limitation can be found throughout the specification as-filed.

In the Office action, the Examiner reiterated the propriety of the withdrawal of claim 49 from consideration. It is respectfully pointed out that claim 46 has been allowed, and that claim 49 depends from claim 46. Accordingly, because claim 46 is generic to claim 49 (which depends from it), claim 49 must be rejoined and allowed. *See* 37 CFR § 1.141, MPEP § 821.04(a). Accordingly, rejoinder and allowance of claim 49 is respectfully requested.

It is noted in the prior Office action (dated October 10, 2006) the Examiner objected to the drawings. Applicants submitted a corrected drawing of Fig. 5 with their last response to overcome the objection. That objection has not been repeated, but the Examiner has not indicated receipt and approval of that drawing change in the most recent Office action. Accordingly, the Examiner is requested to please consider and indicate approval of the corrected drawing of Fig. 5 with his next communication to Applicants.

Claims 9-10 have been rejected under 35 USC § 112, first paragraph as failing to comply with the written description requirement. The Examiner's position is that claim 1 as amended *excludes* the species shown in Fig. 5, which is said to be the subject matter of claims 9 and 10. This rejection is respectfully traversed. Claim 1 states that "no cold heat exchanger of said orifice pulse tube refrigerator penetrates the liquid hydrogen storage vessel." Claim 9 adds the further limitation that a heat transfer body projects into the hydrogen storage volume within the storage vessel, and is thermally coupled to the orifice pulse tube refrigerator. There is no inconsistency in these two limitations. The heat transfer body inside the hydrogen storage volume (e.g. extending from the inner wall of the storage vessel) is not a cold heat exchanger for the orifice pulse tube refrigerator. It is simply a solid body that extends into the hydrogen volume (e.g. can be a conventional heat transfer fin or fins) from the vessel well. A cold heat exchanger from the OPTR can be disposed *outside* of the storage vessel just opposite the heat

transfer body. In this manner, thermal energy can be transferred via conduction from the fins (located inside the vessel) through the vessel wall and into the cold heat exchanger, which is on the outside. Accordingly, the two limitations are not mutually exclusive as the Examiner suggests. Moreover, the original specification describes these features with sufficient clarity to reasonably convey to a person of ordinary skill in the art that applicants were in possession of this structure at the time of filing. *See*, e.g., ¶ [0077], disclosing that a "second stage cold heat exchanger [of the OPTR] is thermally coupled to a heat transfer body such as a fin or fin structure 291 projecting from the inner wall of the storage vessel 320, directly into liquid hydrogen in the sump region 321." The cold heat exchanger need not penetrate the storage vessel to achieve such thermal coupling. It can be achieved through the vessel wall, for example, as is readily apparent. Therefore, it is respectfully requested that this basis of rejection be withdrawn.

Claim 1 has been rejected under 35 USC § 102(b) as being anticipated by each of Saho, Stautner, Inoue et al. (hereafter "Inoue") and Laskaris et al. (hereafter "Laskaris"). All four of these references are directed to cooling super-conducting magnets, coils or so-called "SQUIDs" (superconducting quantum interference devices) and maintaining them in a super-cooled, superconducting state for use in superconductive applications such as NMR spectroscopy (Stautner, Inoue), magnetic flux measurement (Saho) and superconductive rotor applications, e.g. for use in generators (Laskaris). In every case, a coolant fluid, which the Examiner has said can be hydrogen, is used to maintain the target device (coil, magnet, SQUID device) in a super-cooled state. Of course, some sort of vessel or tubing is required to hold the coolant, in which the device to be cooled is submerged or around which the tubing is wrapped to maintain it in the super-cooled state. The Examiner has pointed to this vessel (or to tubing in Laskaris -- see below) in each reference as the liquid hydrogen storage vessel in claim 1. But it is absolutely clear from each reference that even if the coolant could be hydrogen, which none of the references suggests, there is no mechanism or motivation to *deliver* hydrogen from those vessels for use elsewhere. Specifically, in Saho, Stautner and Inoue, a coolant is held in a cryostat to maintain the super-cooled temperature of a submerged component. That coolant is not delivered out from the cryostat in response to any external demand, and no mechanism is provided to achieve this. In Laskaris, coolant flows through a closed loop consisting of passage 38 (Fig. 2) and piping 62, 64 to maintain the field coil 34 at suitably low temperature. In Stautner and

Inoue, a magnet or coil is submerged in liquid helium to make it superconducting. In Saho, SQUID devices are submerged in solidified coolant, e.g. nitrogen for the same purpose, so they will be effective to detect very low level magnetic flux.

In summary, in the references the 'vessels' identified by the Examiner are not adapted or equipped to store and then *deliver* liquid hydrogen or any other coolant material for external uses. They are adapted to retain their coolant (even assuming it could be hydrogen) for the purposes clearly described in each reference: to maintain the super-cooled and superconducting state of the respective elements, magnets, coils, etc.

To more clearly distinguish these references, claim 1 has now been amended to state that the claimed hydrogen storage vessel is "adapted to deliver therefrom a metered quantity of hydrogen on demand for use as a fuel." This feature is nowhere disclosed in any of the references. The coolant in each of the references is to be retained in the coolant vessels or tubing loop to achieve the purposes described, namely to maintain the super-cooled and superconductive state of the immersed (surrounded) magnet, coil, device, etc. Removing the coolant from the coolant vessel or tubing in each of these references not only is not disclosed in the references, but would render the disclosed devices inoperative.

Certainly, none of the disclosed references discloses a vessel *adapted* to deliver hydrogen therefrom in metered quantities on demand. None of the cited references discloses any structure or capability to do this. More broadly, the coolant vessels and tubing disclosed in the cited references for immersing or surrounding coils, magnets, other devices, etc. to maintain them at super-cooled and superconducting temperatures bear no relation to the storage and delivery of metered quantities of hydrogen for use as a fuel. Accordingly, it is respectfully submitted that the rejections of claim 1 have now been overcome.

Claim 2 has been rejected under 35 USC § 102(b) as being anticipated by Laskaris. The Examiner's position is that Fig. 2 in Laskaris discloses, *inter alia*, a liquid hydrogen storage vessel 38 in the shape of a hollow toroid. The Examiner also states that Laskaris discloses a cooling system (60, 70, 66, 52, 56, 64, 62, 10) coupled to an orifice pulse tube generator to abate heat transfer to the "storage vessel" 38. This rejection is respectfully traversed.

Fig. 2 is a race-track super-conducting coil having cooling gas passages. In Fig. 2, a field winding 34 includes a high-temperature super-conducting coil 36. Fluid passages 38 for a cryogenic fluid are included in the coil winding, to provide cryogenic cooling fluid to the coil to

remove heat therefrom. The cooling fluid is delivered to and from the fluid passage 38 surrounding the coil 36 via input/output ports 39. Hence, a cryogenic fluid is circulated through the fluid passage 38 to help cool the coil 36 that it surrounds. That passage 38 is not a storage vessel of any kind. It is simply a length of tubing that has been bent into a loop to surround a field coil. Moreover, that passage 38 does not *store* any fluid; rather it conducts a *circulating* fluid that is constantly replenished via the input/output ports 39 to provide a fresh source of low-temperature coolant to conduct heat out of the coil 36 that it surrounds. Finally, the entire purpose of the cryogenic fluid passing through the passage 38 is to *facilitate* heat transfer therein from the coil 36. Accordingly, it is not understood how the Examiner can suggest that a cooling system is provided to abate heat transfer into that passage 38. Heat transfer into that passage 38, and away from the coil 36, is the entire reason it is present. *See* col. 4, lns. 36-47:

> Fluid passages 38 for cryogenic cooling fluid are included in the coil winding 34. These passages may extend around an outside edge of the SC coil 36. The passageways provide cryogenic cooling fluid to the coils and remove heat from those coils. The cooling fluid maintains the low temperatures, e.g., 27.degree. K., in the SC coil winding needed to promote super-conducting conditions, including the absence of electrical resistance in the coil. The cooling passages have input and output ports 39 at one end of the rotor core. These ports 39 connect to cooling passages 38 on the SC coil t o the cryogen transfer coupling 26.

In fact, the passage 38 is part of the cooling circuit (piping 62,64, coil 58, compressor 52, heat exchanger 54) through which coolant fluid circulates. The components of that circuit cited by the Examiner do not *abate* heat transfer into the passage 38 as the Examiner suggests. They recool the coolant so on the next pass through passage 38 the coolant *promotes* the most efficient heat transfer possible from the coil 36 *into the passage* 38. For all of these reasons, the rejection of claim 2 is respectfully believed overcome.

Claim 45 has been rejected under 35 USC § 103(a) as being obvious over Berry et al., "Hydrogen Storage and Transportation," (hereafter "Berry") in view of Saho. Without addressing the merits of the rejection, it is respectfully pointed out that the earliest date that Berry might qualify as a printed publication is July 24, 2003.[1] The present application claims the

[1] In fact, its effective date as a printed publication may be later, because it is not evident the reference was 'published' on that date. *See* the DISCLAIMER page, second paragraph, which states this is a preprint *intended for publication* and that changes may be made prior to publication. Accordingly, publication may well have been later.

benefit of U.S. provisional patent application serial No. 60/461,639, which was filed April 9, 2003. This benefit claim has been perfected both in the declaration signed by the inventors and also by incorporating it as the first sentence of the present application. Claim 45 is fully supported in the above-mentioned provisional application. Accordingly, Berry does not qualify as prior art and the rejection of claim 45 must be withdrawn.

Claim 46, the only remaining independent claim, has been kindly indicated to be allowed.

New claim 54 depends from claim 1 and further recites hydrogen conditioning equipment adapted to condition hydrogen drawn from the storage vessel to provide conditioned hydrogen in a suitable state for delivery to an engine or fuel cell that consumes the conditioned hydrogen as fuel. None of the references discloses this additional feature in combination with those described in claim 1. Accordingly, claim 54 is respectfully submitted to be independently allowable.

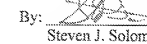
All of the remaining claims are dependent claims, many of which have been graciously indicated to be independently allowable. Accordingly, all claims are now believed to be in condition for allowance.

Should the Examiner have any questions or concerns with respect to the instant submission, or for any other reason to advance the prosecution hereof, he is invited and requested to **please contact the undersigned** at the phone number printed below.

If there are any fees required by this communication that are not mentioned above, please charge any such fees to our Deposit Account 16-0820, Order No. 35494US1.

Respectfully submitted,

PEARNE & GORDON LLP

By: 

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